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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|------------------------------------|------------------------|
| 10/696,545 | 10/29/2003 | Xunming Deng | 03026/PHYS00402 | 7826 |
| 4859 7590 01/30/2009 MACMILLAN SOBANSKI & TODD, LLC ONE MARITIME PLAZA FIFTH FLOOR 720 WATER STREET TOLEDO, OH 43604-1619 | | | EXAMINER BARTON, JEFFREY THOMAS | |
| | | | ART UNIT 1795 | PAPER NUMBER |
| | | | MAIL DATE 01/30/2009 | DELIVERY MODE PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/696,545

Applicant(s)

DENG, XUNMING

Examiner

Jeffrey T. Barton

Art Unit

1795

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 December 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 11, 12, 14 and 75-78 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 11, 12, 14 and 75-78 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SF-08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1 December 2008 has been entered.

Response to Amendment

2. The amendment filed on 1 December 2008 does not place the Application in condition for allowance.

Status of Rejections Pending Since the Office Action of 5 September 2008

3. The previous rejections of claims 1, 11, 12, 14, and 75-78 under 35 U.S.C. §112, first and second paragraphs are withdrawn due to Applicant's amendment.
4. All other rejections are maintained.

Claim Objections

5. Claims 1, 12, 14, 75, and 77 are objected to because of the following informalities:

- a. In claim 1 at line 3, "sub-layers" should be replaced with "sub-window layers", for agreement with later recitations throughout the claims.
- b. In claim 1 at line 18, the recitation "wherein-there" should be amended to read "wherein there".
- c. The phrase "sub-window p-type layer" recited throughout the claims is awkward. Amendment to read "p-type sub-window layer" is recommended, in conjunction with correction of the antecedent basis issues regarding this term noted in the rejection under 35 U.S.C. §1123, second paragraph below.
- d. In claim 12 at line 2, "sub-window-layer" should be amended to read "sub-window layer".
- e. In claim 14 at line 2, "absorber-layer" should be amended to read "absorber layer" and "sub-window-layer" should be amended to read "sub-window layer".
- f. In claim 75 at line 2, "second sub-window" should be amended to read "second sub-window layer".
- g. In claim 77 at line 4, "sub-layers" should be replaced with "sub-window layers", for agreement with later recitations throughout the claim.
- h. In claim 77 at line 18, the recitation "wherein-there" should be amended to read "wherein there".
- i. In claim 77, it appears to be unnecessary to list possible materials for the absorber, first sub-window layer, and second sub-window layer in lines 8-16 of the claim when the claim is later limited to single specific materials for these

layers. Amendment to simply state the materials to which the claimed layers are limited is recommended.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1, 11, 12, 14, and 75-78 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1 at line 12, there is insufficient antecedent basis for "the first and second sub-window p-type layers". The claim is treated as though "the first and second sub-window layers" were recited.

In claim 1 at lines 17-20, there is insufficient antecedent basis for "the second sub-window p-type layer" and "the first sub-window p-type layer", recited at several places within this section. The claim is treated as though "the second sub-window layer" and "the first sub-window layer" were recited.

Claims 11, 12, 14, 75, and 76 depend from claim 1 and are therefore rejected on the same grounds.

In claim 76 at line 1, there is insufficient antecedent basis for "the sub p-layer".

In claim 77 at line 21, there is insufficient antecedent basis for "the substrate".

Claim 78 depends from claim 77, and is rejected for the same reason.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 11, 12, 75, and 76 are rejected under 35 U.S.C. 102(b) as being anticipated by Ma et al.

Ma et al teach a solar cell comprising an absorber layer (Intrinsic Si layer) and a doped window layer comprising two sub-layers (Figure 6; microcrystalline p-type Si(C) and amorphous p-type SiC layers), wherein the first sub-window layer (p-type a-SiC) is adjacent the absorber layer and forms a desirable junction with the absorber layer, wherein the second sub-window layer [microcrystalline p-type Si(C)] is adjacent the first sub-window layer and has high optical transmission (Layers on the order of a few nm thick will have "high" optical transmission; Figure 4), wherein the absorber layer is amorphous silicon (Page 418, 2nd column, 1st full paragraph), wherein the first and second sub-window layers are comprised of microcrystalline silicon [$\mu\text{c Si(C)}$] or combinations or mixtures of amorphous or microcrystalline silicon [e.g. a-SiC or $\mu\text{c Si(C)}$], with the microcrystalline sub-window layer having greater transparency than the amorphous sub-window layer in that it has a wider bandgap. (Figure 6) The mismatch between the first sub-window layer and the absorber can be described as "minimal"

(Figure 6) Ma et al disclose a glass substrate (Page 417, paragraph bridging 1st and 2nd columns) and a TCO adjacent the second sub-window layer. (Figure 6)

Claims 75 and 76 are drawn to formation of a product by a specified process, and do not add any structure that can distinguish these product claims. The claims are rejected on the same grounds as applied to claim 1. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

10. Claims 1, 11, 12, 14, and 75-78 are rejected under 35 U.S.C. 102(b) as being anticipated by Kishimoto et al. (US 6,242,686)

Regarding claim 1, Kishimoto et al disclose a photovoltaic cell (Figure 2) comprising: an absorber layer (4); a doped window layer having two sublayers (7 and 8); wherein the first sub-window-layer (8) is adjacent the absorber layer (4) and forms a desirable junction with the absorber layer and wherein the second sub-window-layer (7) is adjacent the first sub-window layer and has high optical transmission. (Column 8, line 60 - Column 9, line 31; 2 nm thick layer 7 will have high optical transmission); wherein the absorber layer (4) comprises thin film amorphous silicon (Column 6, lines 4-10; Column 9, lines 23-25); the first and second p-type sub-window layers comprise

amorphous silicon (Column 9, lines 11-22); wherein the second sub-window layer has a transparency greater than the first sub-window layer (Layer 7 is 2 nm, layer 8 is 10 nm, and both layers are amorphous silicon, therefore the thinner layer is considered to have greater transparency); and wherein there is a minimal mismatch between the bandgap of the first sub-window layer and the absorber layer. (p-type a-Si is considered to have such a minimal mismatch relative to i-type a-Si, broadly recited)

Regarding claim 11, Kishimoto et al disclose a substrate (1) made of glass.
(Column 8, lines 61-65)

Regarding claim 12, Kishimoto et al disclose a transparent conductive oxide (2) adjacent the second sub-window-layer (7). (Column 8, line 61 - Column 9, line 5)

Regarding claim 14, Kishimoto et al disclose a device as shown in Figures 8 and 9, and teach that layer 10 is deposited as two distinct layers deposited in sequence with a plasma treatment provided between deposition steps. (Column 11, lines 42-51) The first of these distinct layers, which is adjacent to second sub-window-layer 7, reads on the instant first sub-window-layer. The second of these distinct layers, which is adjacent to i-layer 4, reads on the instant buffer semiconductor layer.

Regarding claim 77, in addition to the disclosure cited above in addressing claim 1, Kishimoto et al discloses a stainless steel substrate (Column 4, lines 25-34), an absorber comprising a-SiGe:H and the n-layer comprising a-Si:H. (Column 4, line 65 - Column 5, line 5 in conjunction with Column 6, lines 4-10)

Claims 75, 76, and 78 are drawn to formation of a product by a specified process, and do not add any structure that can distinguish these product claims. The

claims are rejected on the same grounds as applied to claims 1 and 77. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al in view of Sano et al. (US 2001/0037824)

Ma et al teach a solar cell as described above in addressing claims 1, 11, 12, 75, and 76.

Ma et al do not explicitly disclose a buffer layer between the absorber and first sub window layer.

Sano et al teach that enhanced open circuit voltage results from inclusion of an interfacial semiconductor layer (18) between the p-type window and i-type absorber layers in amorphous silicon solar cells. (Paragraphs 0044-0047)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the solar cell of Ma et al by adding an interfacial layer between the window and absorber layers, as taught by Sano et al, because Sano et al teaches that such a layer provides enhance open circuit voltage. (Paragraph 0045)

14. Claims 77 and 78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kishimoto et al. (US 6,242,686) This rejection is provided as an alternative grounds to the rejection made under 35 U.S.C §102(b) above.

Kishimoto et al disclose a photovoltaic cell (Figure 2) comprising: an absorber layer (4); a doped window layer having two sublayers (7 and 8); wherein the first sub-window-layer (8) is adjacent the absorber layer (4) and forms a desirable junction with the absorber layer and wherein the second sub-window-layer (7) is adjacent the first sub-window layer and has high optical transmission. (Column 8, line 60 - Column 9, line 31; 2 nm thick layer 7 will have high optical transmission); wherein the absorber layer (4) comprises thin film amorphous silicon (Column 6, lines 4-10; Column 9, lines 23-25);

the first and second p-type sub-window layers comprise amorphous silicon (Column 9, lines 11-22); wherein the second sub-window layer has a transparency greater than the first sub-window layer (Layer 7 is 2 nm, layer 8 is 10 nm, and both layers are amorphous silicon, therefore the thinner layer is considered to have greater transparency); and wherein there is a minimal mismatch between the bandgap of the first sub-window layer and the absorber layer. (p-type a-Si is considered to have such a minimal mismatch relative to i-type a-Si, broadly recited)

Kishimoto et al list a-Si:H, a-Ge:H, and a-SiGe:H as potential materials for the i-type absorber layer and n-type layer of the cell (Column 4, line 65 - Column 5, line 5 in conjunction with Column 6, lines 4-10), but do not explicitly teach an embodiment where i-type a-SiGe:H and n-type a-Si:H are used together in a cell. Note that a-Si:H is preferred for the p-type layers. (Column 5, lines 3-5)

However, particularly given the low number (3) of disclosed materials for the i-type and n-type layers required in the cell, it would clearly have been obvious to one having ordinary skill in the art to select i-type a-SiGe:H and n-type a-Si:H for the cells, because Kishimoto et al suggest the use of these materials for these required layers of their cells. Such selection would have led only to the predictable result of functioning solar cells.

Claim 78 is drawn to formation of a product by a specified process, and does not add any structure that can distinguish these product claims. The claim is rejected on the same grounds as applied to claim 77. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the

product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Response to Arguments

15. Applicant's arguments filed 5 November 2008 have been fully considered but they are not persuasive.

Applicant argues that Ma et al does not teach variations between the two sub-window layers. The Examiner respectfully disagrees. As shown in Figure 6 of Ma et al, the microcrystalline portion of the window layer has a wider bandgap than the amorphous portion of the window layer, which leads to greater transparency. In addition, the amorphous portion of the window layer is shown in figure 6 as having a minimal bandgap mismatch to the i-type layer, relative to other layers of the cell. Note that there is no specific guidance in the instant application that allows one to determine what is considered to be a "minimal" mismatch. Accordingly, the offset shown in Figure 6 is considered to meet this limitation.

Regarding claim 75, Applicant argues that there is no teaching of the product-by-process limitation recited in the claim. The Examiner again notes that "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not

depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) In the instant case, there is no apparent difference between the structure claimed and that of the prior art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571)272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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